ABSTRACT

Background: Students at pre clinical level at Fatima Jinnah Dental College are taught root canal treatment on endodontic typodonts. Technical quality of the root canal treatments performed by these students was assessed to determine success of teaching methodology and reinforcement of tooth morphology and anatomy between oral biology and endodontics. According to literature search and studies to assess technical quality of root canal obturation length, obturation density (homogeneity), and obturation quality of root canal treatment, three parameters are considered.

Methodology: In this cross-sectional study, obturation quality of 20 anterior and 30 posterior endodontic typodonts were assessed. Chi square analysis was used to compare the quality of root canal obturation between types of tooth.

Results: After assessing the three variables, adequate length control was observed (92.9%), while 7.1% of under filling was seen in both groups. Percentage of teeth showed homogeneity in obturation density that is 30%, 60% teeth showed acceptable, whereas 10% showed unacceptable obturation homogeneity. 55.6% teeth showed perfect obturation taper and 4% showed acceptable.

Conclusion: The obtained results showed root canal treatment quality done by Fatima Jinnah Dental College undergraduate dental students to be adequate on anterior endodontic typodont teeth as compared to posterior endodontic teeth. This will guide the need of incorporating hands on practice of root canal treatments on extracted teeth before students are allowed to work on patients.

Keywords: Root Canal Treatment, Endodontic Typodont, Obturation, Preclinical.

INTRODUCTION

Root canal treatment is a clinical procedure for pain relief and restoration of tooth function, resulting in increased life span of natural dentition. The technical quality of root canal treatment (RCT) has an influence on its result, and accordingly, in preserving the functionality of the tooth. This knowledge is utilized to start learning root canal treatment was 11% (Table 1). A score was given to each parameter (Table 2). Technical quality of root canal treatment was assessed on the basis of root canal obturation length being short of apex, extending beyond apex or at the apex. Obturation density as having voids, or no voids and obturation taper being sufficient or not. Each parameter was given a score of

Current years have seen a noticeable surge in the patient’s demand for root canal treatment in line to the increased age of the people, so it is imperative that dental students possess knowledge and skills of endodontics as well. This guarantees long term patient comfort, aesthetics and prevents reinfection. Overall quality of dental health service in our population will be optimized. Therefore, this study aimed to assess technical quality of root canals performed on endodontic typodonts by pre-clinical students of Fatima Jinnah Dental College.
0, 1 and 2 in accordance with being unacceptable, acceptable and perfect respectively. Scores from all three parameters were added up to give a total score of 6 and students were given marks in the percentage form on a grading sheet according to these scores (Attachment 1). Inter examiner reliability was checked (Table 2). Kappa statistics came out to be 0.61 which indicated inter examiner reliability of more than 60%, suggesting a substantial agreement between all scores.

**Data analysis:** Data was evaluated using SPSS software, version 20.0 (SPSS, Inc., Chicago, IL, USA). Descriptive analysis was done separately for each kind of root canal. Chi-square analysis test was used to compare quality of root canal obturation between types of tooth. The tests were performed at a 0.05 significance level. According to Pearson chi square the value between anterior and posterior teeth was 7.87 (p value 0.795). Therefore, p value was greater than 0.05 where we assumed no significant correlation between anterior and posterior teeth in all three assessment variables.

**RESULTS**

A total of 20 anterior and 30 posterior endodontic teeth were evaluated according to the assessment variables and their results summarized in (Table 1). Under filled obturation length gave similar percentages in both groups at 71%. Nearly 7% difference was found in over filled canals where anterior were more over filled than posterior. Other than that, 92.9% anterior & posteriors were graded as having an adequate length, showing more adequate length control in posterior teeth. Only an extra of 1% severely visible voids were found while measuring density of root canal obturation in posteriors as compared to anterior typodonts. Posterior teeth surged the percentage category of one visible void contrasting anterior. A considerable variation was evaluated in the parameter of adequate density for both groups of teeth where a smaller number of posteriors were more densely filled. Lastly, it was deduced that students had more difficulty creating obturation taper in posterior typodonts where 20% cases were under or over shaped. Anterior typodonts showed more adequate taper when comparing adequacy of obturation taper between the two groups.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Anterior</th>
<th>Posterior</th>
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<tbody>
<tr>
<td>Length</td>
<td>100%</td>
<td>92.9%</td>
</tr>
<tr>
<td>Density</td>
<td>92.9%</td>
<td>77.8%</td>
</tr>
<tr>
<td>Taper</td>
<td>92.9%</td>
<td>80.0%</td>
</tr>
</tbody>
</table>

Table 1: A comparison of length, density and taper of root canal obturation between anterior and posterior teeth.

**Assessment variables**

**Length of Root Canal Obturation**

0= Root filling ending ≥2 mm short of the anatomical apex (under-filling). Root filling limited to the pulp chamber.

1= Root filling ending beyond the anatomical apex (over-filling)

2= Root filling ending 0.5-1 mm short of the anatomical apex (adequate)

**Density of Root Canal Obturation**

0=Inhomogeneous root canal obturation with several visible voids

1=Root canal obturation with only one visible void

2=No void present in the root canal obturation (adequate)

**Taper of Root Canal Obturation**
DISCUSSION

Preclinical exercise on undergraduate students enhances the self-confidence levels and clinical performance of root canal treatment as was discussed by Reem et al in their study 9. Our study was carried out on 20 anterior and 30 posterior endodontic typodonts for assessment of technical quality of root canal treatment. All procedures were done by undergraduate students of Fatima Jinnah Dental College at preclinical campus under the supervision of demonstrators. These demonstrators marked them on each step from access cavity preparation to obturation. Initially the lecture was delivered by trained and experienced endodontist who spoke of the techniques used as well as the armamentarium required. This allowed students at a pre-clinical level to benefit first hand from knowledge of a clinician. A similar approach was followed by faculty at Taibah University in their study11. At a pre-clinical level, students were able to design the access cavity of both anterior and posterior typodont teeth using a variety of burs which also reinforced the concepts of tooth morphology taught to them in their oral biology course. Students were also introduced to proper handling of slow and high speed hand pieces and guided in their proper angulation while working on these typodonts. This has previously also been observed in the study by Reem et al12.

Once all students had completed root canal therapy on the typodonts, experienced endodontists were asked to assess the quality of root canal treatment which resulted in a thorough and in depth analysis of the technical quality of obturation as carried out by James et al in their study13. The assessment was based on three major variables which were further categorized on a scale of 0, 1, and 2. The first category was to evaluate obturation length whether it is short of the apex, beyond the apex or at the apex. The second category was to determine the obturation density measured by the presence or absence of voids. Whereas the third variable marked the shape of the obturation with respect to the consistency of taper (Appendix 11) For success of root canal therapy, students were taught to be vigilant in avoiding avoid procedural errors, whilst having essential knowledge of root filling technique to minimize future inconvenience to the patient. 11 Our study showed 10% underfilled root canal obaturtions for both anterior and posterior typodonts. It has been suggested that this can be due to ledge formation caused by improper cleaning and shaping of canals and debris accumulation11. Prior studies showed 69.6% root fillings of adequate length, reported by Ribeiro et.al5. In another study, percentage of root canal treatment with sufficient length was 65.5% with NiTi rotary technique and 34.5% in stainless steel hand group which is inferior compared to our study 12. A high percentage of adequate length control was seen in posterior typodonts compared to anterior typodont obturations, indicating better ability of the students to file and obturate shorter canals. A result of 15% in anterior and 6.6% in posterior was graded as overfilled. This could have been caused by overzealous instrumentation or faulty length control. In comparison to our study, previous studies have used extracted teeth and radiographic imaging to categorize root fillings as acceptable or unacceptable 13.

In another study, 25% extracted teeth were preserved endodontically where 138 (53.3%) had an objectionable root canal quality obturation9. Sufficient compactness of root canal filling is a vital factor for long-term accomplishment of endodontic treatment 14. Higher percentage of root fillings with sufficient density was seen in anterior tyodonts at 45% while 5% and 6% having severe voids was recorded in anterior and posterior tyodonts respectively. This could be a lack of proper lateral condensation and excessive use of sealer15. In this study, 45% of canals were of sufficient density. This result is greater in comparison to other studies which reported 27.6%–35.5% of canals with adequate density16. In contrast to works done by Moussa-Badran et al and other authors17,18,19, this study showed no substantial association between type of tooth and density of the filling, though to some extent different criteria was used, which makes assessment tough. In addition to this, Khabbaz et al and various other studies20,21,22 considered other parameters like procedural errors to determine technical quality of obturation. They did not record any missed canals, but reported apical foramen and root perforation in 11.8% and 32.6% of canals respectively. In a study by Rafeek et al.1.5% cases had fractured instruments 3,24,25.

Certain restrictions to this study should be considered, the use of endodontic typodonts lacked the experience of anatomical aberrations present in the natural root canal system. These are encountered with ease while learning root canal treatments on extracted teeth. Students did not have the need of using radiographs as the endodontic typodonts are transparent which also compromised ability to gain experience of radiographic interpretation in the future while working in the patient’s mouth. Many students were even seen trimming excess gutta-percha points from the bottom of the typodont when canals were overfilled. The working length was effortlessly determined and artificial teeth gave way with ease under a high-speed hand piece as compared to the natural teeth. These limitation will help us devise better tools for endodontic tooth simulation in the future to train students at pre-clinical level.

CONCLUSION

To conclude, the obtained results showed that the quality of root canal treatment performed by Fatima Jinnah Dental College undergraduate dental students showed better technical quality on anterior endodontic typodonts as compared to posterior endodontic typodonts showing a necessity for practice on extracted teeth especially posterior teeth before being given actual patients.

Ethical approval / disclosure: Institutional Ethical Review Committee of Fatima Jinnah Dental College and Hospital provided the ethical clearance (Ref No: FJDC/2016-0702) after determining that the study was in vitro and posed no harm to students.

Authors’ contribution: RR was the primary author who collected the data and wrote the manuscript. MB did the interpretation and analysis. MB helped in selecting the topic and re-analyzed the data for inter-examiner reliability. ZA: contributed in write-up and final revision of the manuscript. HA contributed reviewed the final write up. GA helped in literature search. No financial grant has been received for this study.

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